

As taught by U.S. Pat. No. 4,508,309, such mold plates have half molds, each of which is registered with another half mold in the opposite mold plate. It has been found that a golf ball is formed with a cover in accordance with the present invention when the half-shells are compression molded about a core at about 250° to 400° F. The molded balls are then cooled while still in the mold and finally removed when the cover is hard enough to be handled without deforming.

Alternatively, golf balls can be covered solely with the use of an injection molding technique utilizing an injection molding machine in which the core assembly is placed in a mold cavity. The core assembly is held in place through the use of several retractable pins. Such injection molding machines are well known in the art. The molten cover material is injected into the cavity surrounding the core. As the cover material cools and hardens, the pins retract and the molded ball is ejected from the mold. The balls then undergo conventional finishing operations such as buffing, painting and stamping. This type of cover construction is generally referred to as a one-piece cover.

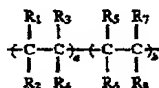
The present invention can be used in forming golf balls of any desired size. While USGA specifications limit the size of a competition golf ball to more than 1.680 inches in diameter, golf balls of any size can be used for leisure golf play. The preferred diameter of the golf balls is from about 1.680 inches to about 1.800 inches. The more preferred diameter is from about 1.680 inches to about 1.760 inches. A diameter of from about 1.680 inches to about 1.740 inches is most preferred, however diameters anywhere in the range of from 1.70 to about 1.95 inches can be used. Oversize golf balls with diameters above about 1.760 inches to as big as 2.75 inches are also within the scope of the present invention.

All patents cited in the foregoing text are expressly incorporated herein by reference in their entirety.

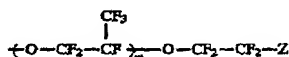
It will be understood that the claims are intended to cover all changes and modifications of the preferred embodiments of the invention, herein chosen for the purpose of illustration, which do not constitute a departure from the spirit and scope of the invention.

— What is claimed is:

1. A golf ball having an outer surface wherein the improvement comprises forming at least said outer surface of a thermoplastic material comprising at least one functionalized fluoropolymer, wherein said fluoropolymer has the formula



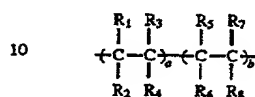
in which a is a number from 1 to 100; b is a number from 99 to 1;  $R_1$ – $R_8$  are independently selected from the group consisting of H, F, alkyl, and aryl; and  $R_6$  is H, F, or a moiety of the formula



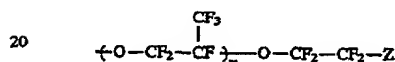
in which m is a number from 1 to 18; and Z is selected from the group consisting of  $\text{SO}_2\text{F}$ ,  $\text{SO}_3\text{H}$ ,  $\text{SO}_3^-\text{M}^{v+}$ ,  $\text{COF}$ ,  $\text{CO}_2\text{H}$ , and  $\text{CO}_2^-\text{M}^{v+}$ , wherein v is the valence of M and M is a cation selected from Group I, Ia, IIa, IIb, IIIa, IIIb, IVa, IVb, and transition elements.

2. The golf ball of any claim 1 wherein said outer surface is comprised of up to about 100 wt % of said functionalized fluoropolymer.

3. A golf ball having at least an outer surface formed of a material selected from the group consisting of thermoplastic materials and thermosetting materials, wherein the improvement comprises applying upon said outer surface at least one layer of a coating material, said coating material comprising at least one functionalized fluoropolymer, wherein said fluoropolymer has the formula



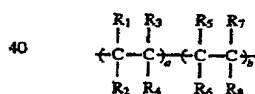
in which a is a number from 1 to 100; b is a number from 99 to 1;  $\text{R}_1$ - $\text{R}_7$  are independently selected from the group consisting of H, F, alkyl, and aryl; and  $\text{R}_8$  is H, F, or a moiety of the formula



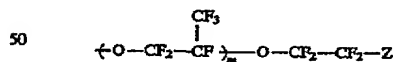
in which m is a number from 1 to 18; and Z is selected from the group consisting of  $\text{SO}_2\text{F}$ ,  $\text{SO}_3\text{H}$ ,  $\text{SO}_3^-\text{M}^{++}$ ,  $\text{COF}$ ,  $\text{CO}_2\text{H}$ , and  $\text{CO}_2^-\text{M}^{++}$ , wherein v is the valence of M and M is a cation selected from Group I, Ia, IIa, IIb, IIIa, IIIb, IVa, IVb, and transition elements.

4. The golf ball of claim 3 wherein said coating material is comprised of up to about 100 wt % of said functionalized fluoropolymer.

5. A golf ball having an outer surface, said golf ball having at least one coating layer deposited upon said outer surface, said outer surface formed of a material selected from the group consisting of thermoplastic materials and thermosetting materials, wherein at least said outer surface and said coating layer comprise at least one functionalized fluoropolymer, wherein said fluoropolymer has the formula

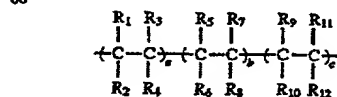


in which a is a number from 1 to 100; b is a number from 99 to 1;  $\text{R}_1$ - $\text{R}_7$  are independently selected from the group consisting of H, F, alkyl, and aryl; and  $\text{R}_8$  is H, F, or a moiety of the formula



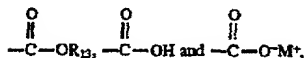
in which m is a number from 1 to 18; and Z is selected from the group consisting of  $\text{SO}_2\text{F}$ ,  $\text{SO}_3\text{H}$ ,  $\text{SO}_3^-\text{M}^{++}$ ,  $\text{COF}$ ,  $\text{CO}_2\text{H}$ , and  $\text{CO}_2^-\text{M}^{++}$ , wherein v is the valence of M and M is a cation selected from Group I, Ia, IIa, IIb, IIIa, IIIb, IVa, IVb, and transition elements.

6. The golf ball of any one of claims 1, 3 or 5 wherein said fluoropolymer is a terpolymer having the formula



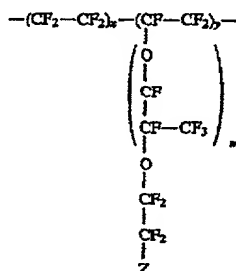
wherein C is a number from 1 to 50;  $\text{R}_9$ - $\text{R}_{11}$  are independently selected from the group consisting of H, F, alkyl and

aryl; and  $R_{12}$  is selected from the group consisting of



wherein  $R_{12}$  is a  $C_1$ - $C_{12}$  linear or branched chain alkyl group.

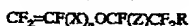
7. The golf ball of any claims 1, 3 or 5 wherein said fluoropolymer has the formula



wherein  $m$  is 1-12;  $x$  is 1-100;  $y$  is 99 to 1; and  $Z$  is selected from the group consisting of  $\text{SO}_2\text{F}$ ,  $\text{SO}_3\text{H}$ ,  $\text{SO}_3^-\text{M}^{v+}$ ,  $\text{COF}$ ,  $\text{CO}_2\text{H}$ , and  $\text{CO}_2^-\text{M}^{v+}$ , wherein  $v$  is the valence of  $M$  and  $M$  is a cation selected from Group I, Ia, IIa, IIb, IIIa, IIIb, IVa, IVb, and transition elements.

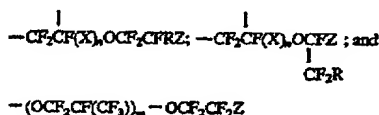
8. The golf ball of claim 7 wherein  $m$  is a number from 7 to 10.

9. The golf ball of any one of claim 7 wherein said fluoropolymer is formed by copolymerizing a vinyl ether having a structure selected from the group consisting of



wherein  $X$  is  $\text{O}(\text{CF}_2)_{2-10}$ ,  $\text{OCF}_2\text{CFY}$ , or  $\text{OCFYCF}_2$ , with  $Y=\text{F}$  or  $\text{CF}_3$ ;  $Z$  is selected from the group consisting of  $\text{SO}_2\text{F}$ ,  $\text{SO}_3\text{H}$ ,  $\text{SO}_3^-\text{M}^{v+}$ ,  $\text{COF}$ ,  $\text{CO}_2\text{H}$ , and  $\text{CO}_2^-\text{M}^{v+}$ , wherein  $v$  is the valence of  $M$  and  $M$  is a cation selected from Group I, Ia, IIa, IIb, IIIa, IIIb, IVa, IVb and transition elements;  $R$  is  $\text{F}$  or a perfluoroalkyl group having up to 10 carbon atoms; and  $n$  is 0, 11, or 2.

10. The golf ball of any one of claims 1, 3 or 5 wherein said fluoropolymer has molecular units selected from the group consisting of



wherein  $X$  is  $\text{O}(\text{CF}_2)_{2-10}$ ,  $\text{OCF}_2\text{CFY}$  or  $\text{OCFYCF}_2$ ;  $Z$  is selected from the group consisting of  $\text{SO}_2\text{F}$ ,  $\text{SO}_3\text{H}$ ,  $\text{SO}_3^-\text{M}^{v+}$ ,  $\text{COF}$ ,  $\text{CO}_2\text{H}$ , and  $\text{CO}_2^-\text{M}^{v+}$ , wherein  $v$  is the valence of  $M$  and  $M$  is a cation selected for the group I, Ia, IIa, IIb, IIIa, IIIb, IVa, IVb and transition elements;  $R$  is  $\text{F}$  or a perfluoroalkyl group having up to 10 carbon atoms;  $n$  is 0, 1 or 2; and  $m$  is 7-10.

11. The golf ball of any one of claims 1, 3 or 5 wherein said fluoropolymer is a perfluoropolymer that is sulfonated or carboxylated.

12. The golf ball of claim 1 or 5 wherein said fluoropolymer comprises from about 10 to about 90% of at least said

outer surface and wherein about 90 to about 10% of said outer surface is comprised of one or more non-fluorinated thermoplastic polymers selected from the group consisting of ionomeric polymers, non-ionomeric polymers, and mixtures thereof.

13. The golf ball of claim 1 or 5 wherein said ball comprises at least one cover layer and a core, and wherein said outer surface comprises said cover layer.

14. The golf ball of claim 13 comprising a core having two or more layers.

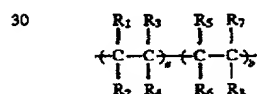
15. The golf ball of claim 13 wherein said fluoropolymer is blended with at least one additional thermoplastic ionomer.

16. The golf ball of claim 13 wherein said fluoropolymer is blended with at least one non-ionomeric thermoplastic resin.

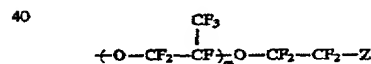
17. The golf ball of claim 3 or 5 wherein said fluoropolymer comprises from about 10 to about 90% of said coating and wherein about 90 to about 10% of said coating is comprised of one or more non-fluorinated thermoplastic polymers selected from the group consisting of ionomeric polymers, non-ionomeric polymers, and mixtures thereof.

18. A method of enhancing the cut and abrasion resistance of a golf ball comprising the steps of:

- a) forming a golf ball core; and
- b) forming a cover around said core by molding a cover stock material comprising a fluoropolymer about said core, wherein said fluoropolymer has the formula

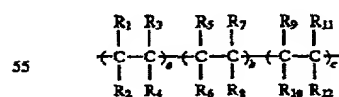


in which a is a number from 1 to 100; b is a number from 99 to 1; R<sub>1</sub>-R<sub>7</sub> are independently selected from the group consisting of H, F, alkyl, and aryl; and R<sub>8</sub> is H, F, or a moiety of the formula

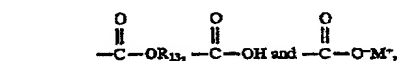


in which m is a number from 1 to 18; and Z is selected from the group consisting of SO<sub>2</sub>F, SO<sub>3</sub>H, SO<sub>3</sub><sup>-</sup>M<sup>+</sup>, COF, CO<sub>2</sub>H, and CO<sub>2</sub><sup>-</sup>M<sup>+</sup>, wherein v is the valence of M and M is a cation selected from Group I, Ia, IIa, IIb, IIIa, IIIb, IVa, IVb, and transition elements.

19. The method of claim 18 which further comprises choosing a cover stock material comprising a fluoropolymer having the formula



wherein c is a number from 1 to 50; R<sub>9</sub>-R<sub>11</sub> are independently selected from the group consisting of H, F, alkyl and aryl; and R<sub>12</sub> is selected from the group consisting of

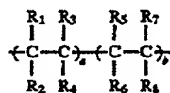


wherein R<sub>13</sub> is a C<sub>1</sub>-C<sub>12</sub> linear or branched chain alkyl group.

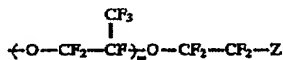
20. The method of claim 18, wherein said fluoropolymer is selected from the group consisting of perfluoropolymers that are sulfonated or carboxylated and their salts.

21. The method of claim 20, wherein said cover material comprises from about 10 to about 90% of said fluoropolymer and wherein from about 90 to about 10% of the cover material is comprised of one or more non-fluorinated thermoplastic polymers selected from the group consisting of ionomeric polymers, non-ionomeric polymers and mixtures thereof.

22. A method of enhancing the cut resistance, abrasion resistance, and durability of a golf ball which comprises forming a golf ball and applying to the golf ball a coating composition comprising a fluoropolymer, wherein said fluoropolymer has the formula



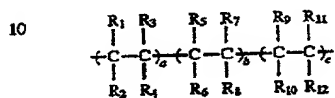
in which a is a number from 1 to 100; b is a number from 99 to 1;  $R_1$ - $R_7$  are independently selected from the group consisting of H, F, alkyl, and aryl; and  $R_8$  is H, F, or a moiety of the formula



in which m is a number from 1 to 18; and Z is selected from the group consisting of  $\text{SO}_2\text{F}$ ,  $\text{SO}_3\text{H}$ ,  $\text{SO}_3^-\text{M}^{n+}$ ,  $\text{COF}$ ,  $\text{CO}_2\text{H}$ ,

and  $\text{CO}_2\text{M}^{v+}$ , wherein  $v$  is the valence of  $M$  and  $M$  is a cation selected from Group I, Ia, IIa, IIb, IIIa, IIIb, IVa, IVb, and transition elements.

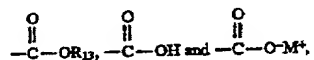
- 5 23. The method of claim 22 which further comprises applying to said golf ball a coating composition comprising a fluoropolymer having the formula



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wherein  $c$  is a number from 1 to 50;  $\text{R}_9$ - $\text{R}_{11}$  are independently selected from the group consisting of H, F, alkyl and aryl; and  $\text{R}_{12}$  is selected from the group consisting of

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wherein  $\text{R}_{13}$  is a  $\text{C}_1$ - $\text{C}_{12}$  linear or branched chain alkyl group.

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